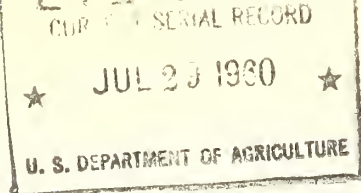


Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Ag845m
p. 2



PACKAGING CALIFORNIA CAULIFLOWER



MARKETING RESEARCH REPORT NO. 414

TRANSPORTATION AND FACILITIES RESEARCH DIVISION
AGRICULTURAL MARKETING SERVICE
U. S. DEPARTMENT OF AGRICULTURE

PREFACE

This report is one of many by the Agricultural Marketing Service, concerned with improving the packages, shipping containers, and packing methods for fruits and vegetables. The study on which the report is based is part of a broad research program aimed at improving marketing efficiency and expanding markets for agricultural products.

Donald R. Stokes supervised this study, and the following growers and packers cooperated: Bonita Packing Co., Santa Maria, Calif.; Bruce Church, Inc., Salinas, Calif.; California Vegetable Growers Assn., Lompoc, Calif.; Fudenna Brothers Co., Santa Maria, Calif.; T. R. Merrill Packing Co., Salinas, Calif.; H. Y. Minami and Sons, Santa Maria, Calif.; Oceano Packing Co., Santa Maria, Calif.; Phelan-Taylor Produce Co., Inc., Oceano, Calif.; Pismo-Oceano Vegetable Exchange, Oceano, Calif.; Point Sal Growers, Guadalupe, Calif.; Jim Watkins Co., Watsonville, Calif.; Western Packing Co., Guadalupe, Calif.; and L. S. Williams, Centerville, Calif.

Receiving warehouses, chain distribution centers, and brokers in Midwestern and Eastern States also cooperated in the study.

Some related publications previously issued include: Fresh Produce Packaging Practices in the United States, MRR 341, July 1959; Prepackaging Firm Ripe Peaches, An Interim Report, AMS-312, June 1959; Evaluation of Shipping Containers for Western Lettuce, MRR 248, July 1958; Evaluation of Shipping Containers for Florida Avocados, MRR 228, May 1958; Packing California Potatoes in Fiberboard Boxes, MRR 214, February 1958; Development of Carrot Prepackaging, MRR 185, June 1957; New Shipping Containers for Plums, MRR 128, June 1956; Prepackaging Tomatoes, MRR 20, October 1952; and Prepackaging Apples at Point of Production, AIB 29, January 1951.

This report is on packaging and shipping California cauliflower from January 1957 to May 1959. Work was conducted in areas from the Centerville-Irvington area of northern California to the Guadalupe-Santa Maria area in southern California.

Washington, D. C.

July 1960

CONTENTS

	<u>Page</u>
Summary	5
Introduction	7
How study was conducted	7
Limitations of methods used	8
Description of conventional bulk containers	8
WGA crate	8
Pony crate	10
Wood flat	10
Description of new master shipping containers and films	10
Wood flat or crate	11
One-piece fiberboard box for single layer	11
Full-telescope fiberboard box for single layer	12
One-piece fiberboard box for double layer	12
Cellophane without laminated foil strips	15
Cellophane with laminated foil strips	15
Weight of cauliflower, by stage of trimming and by container	15
Materials cost of containers and films	17
Cost and amount of direct labor for packing and loading	17
Operations performed	18
Labor requirements	22
Labor cost	24
Cost of transporting cauliflower to terminal market, by type of container	25
Freight charges	25
Refrigeration charges	27
Loading materials	28
Comparative total cost of packing and shipping	29
Arrival condition of cauliflower and containers	30
Test shipments	30
Terminal and retail market evaluations	30
Trade reaction to bulk and prepackaged cauliflower	33
At terminal level	34
At retail level	34
F.o.b. prices paid for cauliflower, by type of container	35
Conclusions	35

SUMMARY

Research to evaluate various conventional and experimental containers for bulk and prepackaged cauliflower was undertaken in 13 California packing houses during the late winter and early spring of 1957, 1958, and 1959. Cost of packing materials, labor, and transportation was determined per container and per 100 pounds of edible cauliflower.

The bulk containers evaluated were the WGA and pony crates and the wood flat. Master shipping containers for prepackaged (overwrapped) cauliflower were the one-piece fiberboard box for single layers of the vegetable, the full-telescope fiberboard box for single layers, the one-piece fiberboard box for double layers, and the wood flat.

The two least expensive ways to get 100 pounds of edible cauliflower to market were found to be to trim it fully, overwrap it, and ship it in fiberboard boxes; or partially trim it and bulk pack it in the wood flats. In 1959, the average direct cost of packing, loading, and shipping 100 pounds of edible prepackaged cauliflower from California to New York City was \$7.62, compared to \$8.82 for untrimmed bulk cauliflower.

The most expensive ways to get cauliflower to market were to prepackage it in the wood flat, at a cost of \$8.97 per 100 pounds of edible cauliflower, or to bulk pack it in the pony crate, at a cost of \$9.41.

Fully trimmed cauliflower was assumed to be edible cauliflower. The average weight of an untrimmed head of cauliflower was 5.54 pounds. After fully trimming for prepackaging, it weighed an average of 1.62 pounds. The reduction in weight in trimmed inedible leaves was 3.92 pounds, or 70 percent.

Wood containers cost more than fiberboard containers. However, the combined cost of film and containers (either fiberboard or wood) for prepackaged cauliflower was higher than the cost of the wood containers alone for the bulk pack. When the wood flat was used for prepackaged cauliflower, the average combined container and film cost was \$3.70 per 100 pounds of edible cauliflower, compared with \$2.67 for the wood flat alone for the bulk pack. The average cost of fiberboard boxes and film for 100 pounds of edible cauliflower was \$2.84.

The labor requirements for packing 100 pounds of edible cauliflower varied among the containers, depending on the amount of trimming, number of heads packed per container, and method of wrapping, packing, and closing. The bulk cauliflower required only about half as much trimming as the packaged cauliflower and did not require any wrapping. The wood containers were assembled before delivery, whereas the fiberboard containers were assembled at the packinghouse.

The average time required to pack 100 pounds of edible cauliflower in all bulk containers was 19.17 man-minutes, compared with 35.82 man-minutes to trim fully, overwrap, and pack in master containers.

The average labor cost to bulk pack 100 pounds of edible cauliflower was 48.0 cents, compared with 89.5 cents for the full trim and overwrap. The labor cost to pack the WGA crate was the least for bulk cauliflower, 37.7 cents, compared to 80.7 cents for the full-telescope fiberboard box for a single layer, the least cost for prepackaged cauliflower.

Freight charges were twice as high per 100 pounds of edible cauliflower in bulk containers as on fully trimmed and prepackaged heads of cauliflower in the lighter containers.

The highest freight charge per 100 pounds of edible cauliflower was \$5.64 for the WGA bulk crate, compared with \$2.82 for the full-telescope fiberboard box for a single layer.

The number of containers per car varied from 340 WGA crates to 1,068 full-telescope fiberboard boxes for single layers. This variation in number of containers per car was almost directly proportionate to the amount of inedible leaves and stalk trimmed off the cauliflower heads--the more leaves and stalk trimmed, the more containers per car.

In transit from California to New York, it cost an average of 34.8 cents to refrigerate 100 pounds of edible cauliflower in the bulk pack, compared with 65.4 cents to refrigerate the same amount of prepackaged cauliflower.

In bracing materials required, the wood flat was the most expensive, with both bulk and prepackaged packs. The cost was 13.5 cents per 100 pounds of edible cauliflower. The one-piece fiberboard box for double layers was not braced. The average cost of bracing materials for the one-piece fiberboard box for a single layer and the full-telescope fiberboard box for a single layer, per 100 pounds of edible cauliflower, was 4.15 cents, compared with 6 cents for the wood containers with bulk packs.

Arrival condition of cauliflower at the terminal market was best in the fiberboard containers. The average bruising and discoloration of all prepackaged cauliflower was less, in all degrees, than of bulk cauliflower. Total bruising (slight, damage, and serious) for all prepackaged cauliflower was 15.1 percent compared with 21.8 percent for the bulk packs.

Trade reaction was generally more favorable to prepackaged cauliflower than to the bulk packs. Comments indicated that overwrapped cauliflower "reduced handling" and "sold better." A few favored bulk heads because "people still like to take them in their hands and feel what they are getting."

PACKAGING CALIFORNIA CAULIFLOWER

By

John L. Ginn and Philip W. Hale, agricultural economists
Transportation & Facilities Research Division
Agricultural Marketing Service
U. S. Department of Agriculture

INTRODUCTION

California is the leading State in the production of cauliflower. The climate and soil along the coast are well suited for almost year-around production. The number of acres planted and the yield per acre have increased steadily during the 1950's.

During the decade of the 1950's, the cost of labor, packing materials, and transportation in the cauliflower industry has continued to rise. The rising cost of transportation alone has contributed to a change in the industry. Until 1955, approximately 90 percent of the cauliflower shipped from California was in bulk, in wood containers. In 1958, 40 to 50 percent was overwrapped (prepackaged in film) and shipped in master containers. In 1959, about 60 percent of California cauliflower for fresh market was prepackaged before shipment. In the Watsonville-Salinas area of California, some shippers were prepackaging 90 to 95 percent of their total volume. In prepackaging cauliflower, about half of the weight is trimmed off with the heavy leaves and stalk, so that twice as many heads can be shipped in the same space.

How Study Was Conducted

Research on California cauliflower shipments was conducted from January to March in 1957, in March and April 1958, and from March to May in 1959. Thirteen packing plants along the coast from Centerville in north central California to Guadalupe in south central California cooperated in these studies. In 1957 and 1958, economic data on direct labor, packing materials, transportation, and refrigeration costs were obtained.

In 1959, similar economic data were obtained, and test shipments were originated in California and inspected in terminal markets east of the Mississippi. Three bulk containers were evaluated: The WGA (Western Growers Association) crate, the pony crate, and the wood flat. Master shipping containers for prepackaged heads that were evaluated were the one-piece single-layer fiberboard box, the two-piece full-telescope single-layer fiberboard box, the one-piece double-layer fiberboard box, and the wood flat. Two types of cellophane overwraps also were evaluated, the 300-gage semimoistureproof cellophane with laminated foil strips along two edges for forming closures, and the 300-gage semimoistureproof cellophane without laminated foil strips. The latter was heat-sealed for closure.

The detailed objectives of this study were to (1) determine the comparative requirements for direct labor in packing the various containers and in using different packing methods and procedures, (2) determine the approximate amount of edible cauliflower in each type of container, (3) assist shippers in developing and adopting more efficient packaging operations, (4) determine transportation and refrigeration costs, (5) determine arrival condition at both terminal and retail levels of cauliflower by type of container, and (6) obtain wholesale and retail trade reaction to the various containers. Within the packing plants, the labor requirements to assemble, pack, close, and load shipping containers were obtained. Weights were taken on cauliflower heads at various stages of processing for shipment in different types of containers.

Limitations of Methods Used

Although the cauliflower packing sheds were chosen in an attempt to assure an adequate sample within the area in which the work was done, the plants were not necessarily representative of all cauliflower packing sheds in the western part of this country.

Some of the containers were evaluated in different plants with different trimming and packing practices. Thus differences in the direct labor costs of packing the various containers reflected, in part at least, the efficiency levels of the practices employed.

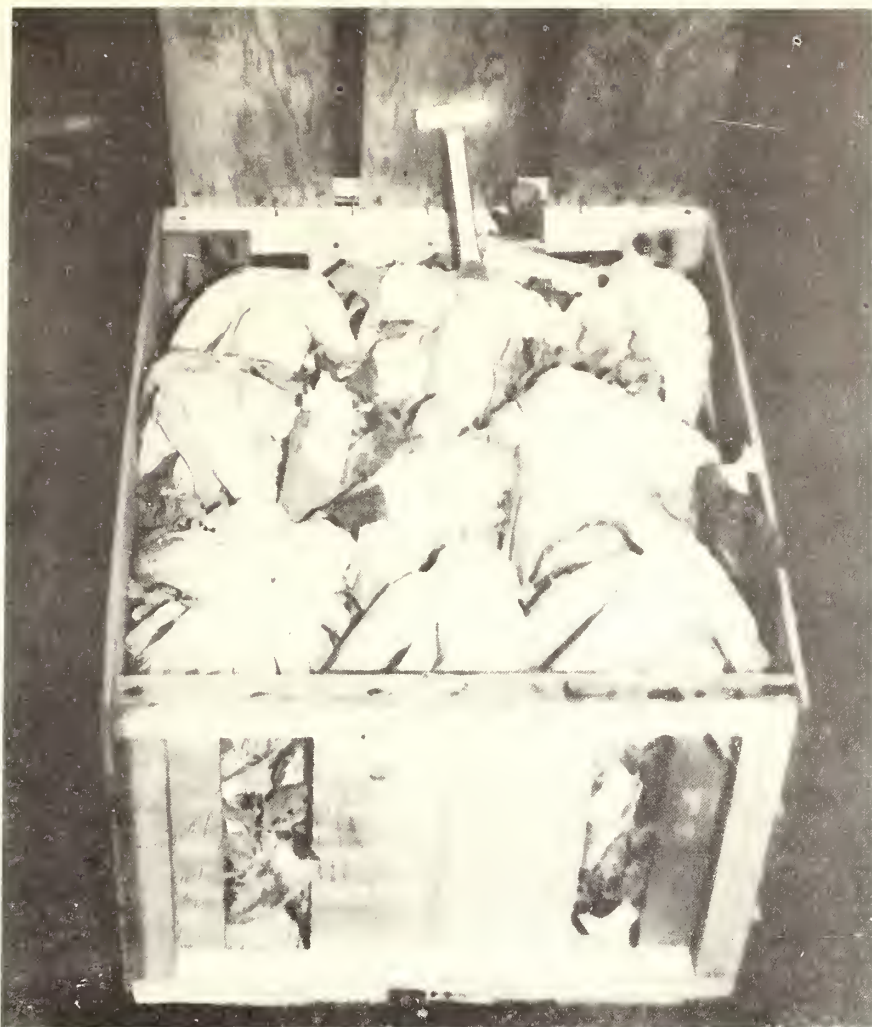
Researchers were unable to obtain complete data on two of the containers. Information was obtained at the point of production, but observations on arrival condition and trade reaction to these two containers were not made in the terminal markets. These containers were the bulk-packed pony crate and the one-piece fiberboard box for a single layer of prepackaged cauliflower.

DESCRIPTION OF CONVENTIONAL BULK CONTAINERS

The small wood flats being used for shipping bulk cauliflower are relatively new. These flats are used for both bulk and prepackaged cauliflower. In the Guadalupe, Santa Maria, and Oceano areas, most of the loads shipped are mixed, containing cauliflower, broccoli, cabbage, escarole, and artichokes. All of these mixed loads are top-iced. As a result, wood containers predominate in this area. A description of the conventionally used bulk containers follows:

WGA Crate

The WGA crate is container No. 935 in Western Freight Container Tariff 1-E. The inside dimensions are $20\frac{1}{2}$ by $18\frac{1}{2}$ by $14\frac{1}{2}$ inches. It is constructed of wood slats and is assembled and closed by a semiautomatic nailing machine. Eighteen heads of partially trimmed cauliflower are normally packed in the crate. Some shippers refer to it as the double pack, because of the method used in packing it (fig. 1). Nine heads of cauliflower are packed with stalks down in the bottom of the container. A blotter-type pad is placed over the top of the layer, and nine heads are packed with stalks up.



BN-9357-X

Figure 1.--Cauliflower bulk packed in container No. 935, commonly called the WGA crate.

After the crate is packed, the top-layer stalks protrude several inches higher than the container and, in lidding, pressure must be applied. Most plants use a semiautomatic hydraulic lid press or a semiautomatic nailing machine. These machines apply tremendous pressure which often causes considerable bruising damage to the cauliflower heads.

The WGA crate also is used for shipping such commodities as lettuce, cabbage, and endive. Until recently, the WGA crates were preferred by most buyers who bought bulk cauliflower. It is sturdy but large and heavy. The average gross weight of the cauliflower from one field, packed in WGA crates, was 64 pounds. However, the weight ranges from 50 to 75 pounds, depending on the variety of cauliflower and the packing method. The tare weight of the WGA crate is about 9 pounds.

Approximately 15 percent of the cauliflower in the Santa Maria, Oceano, and Guadalupe areas was shipped in WGA crates in 1959.

Pony Crate

The pony crate is sometimes called the standard cauliflower crate. It is container No. 405 in TCFB Tariff 44-M. It is somewhat similar to the WGA crate. It is constructed of wood slats and is assembled by a semiautomatic nailing machine. Inside dimensions are 21-3/4 by 18 by 8½ inches. Twelve heads of cauliflower usually are packed in the pony crate. However, the pack ranges from 11 to 14 heads, depending on the size of cauliflower and amount of leaves trimmed from the heads. The top is secured by a semiautomatic nailing machine, or manually.

Twelve heads are packed stalk down. The leaves that protrude are trimmed flush with the top of the crate. The standard weight of this crate is 42 pounds when packed, and the tare weight is 6.4 pounds.

This crate is seldom used in California for shipping cauliflower to eastern markets. Both the WGA and pony crates are used in sending cauliflower to local or nearby markets.

Wood Flat

The wood flat is constructed of wood slats and assembled by a semiautomatic nailing machine. Some shippers call it the "Bikini crate." Inside dimensions are approximately 22 by 17-3/4 by 6 inches. The tare weight is approximately 5.4 pounds and the average gross weight is about 32 pounds. The sides of the wood flat are solid one-piece boards. The top and bottom are composed of three slats of wood approximately 4 inches wide and about 1/5 inch thick.

In the Guadalupe, Santa Maria, and Oceano areas, shippers are packing approximately 50 percent of their bulk cauliflower in the wood flats. Generally, 12 heads of partially trimmed cauliflower are packed, stalks down, in this flat. The contents are trimmed again by cutting off leaves which protrude above the crate. A blotter-type pad is placed over the cauliflower heads and the top is secured manually or by a semiautomatic nailing machine.

The wood flat has been used for several years for cellophane-wrapped cauliflower. The use of this crate for shipping bulk cauliflower is another attempt by shippers to reduce direct packing costs. Almost all of the bulky leaves are trimmed off the cauliflower heads before they are packed in the wood flats, considerably reducing the gross weight of the container. A packer using wood flats can ship 10,080 heads of cauliflower per carload, compared to 6,120 heads in WGA crates.

DESCRIPTION OF NEW MASTER SHIPPING CONTAINERS AND FILMS

Shipping containers for prepackaged cauliflower in California are of two general types--fiberboard and wood. The wood flats, described previously, were observed in use primarily in the Guadalupe, Santa Maria, and Oceano areas, and the fiberboard containers in the Centerville, Irvington, Watsonville, and Salinas areas. There are several variations in types and slight differences

in sizes of the fiberboard master shipping containers. The main differences are those between the single-layer and double-layer boxes.

Wood Flat or Crate

The wood flat is the container described earlier as being used for shipping bulk cauliflower. Usually 12 heads of cauliflower are trimmed, overwrapped with cellophane, and packed in this crate; however, 14 to 16 smaller heads are sometimes packed. Fully packed and topped, the wood flat averages 24 pounds with a range of 22 to 26 pounds (fig. 2).



BN-9333-X

Figure 2.--Wood flat containing cellophane-wrapped cauliflower. This container is the same as the wood flat for bulk cauliflower.

One-Piece Fiberboard Box for Single Layer

The one-piece corrugated fiberboard box for a single layer of cauliflower has double walls on both ends and one-half the width of each side. The half of each side that is not double-walled folds horizontally across the center to form a double-walled partition. This box is reinforced at each corner with a

strip of fiberboard. There are twelve $1\frac{1}{4}$ -inch ventilation holes on the bottom, and one $3\frac{1}{4}$ -inch by $3/4$ -inch slot at each end to admit extended tabs on the box below when stacking.

The inside dimensions are 22 by 17 by $5\frac{1}{2}$ inches. The box has a strength of 275 pounds per square inch by the dry mullen test. The tare weight is 2.5 pounds. The container is assembled manually with the aid of a semiautomatic stitching machine. When packed, these boxes are stacked two high and stapled together. The top container is covered by a sheet of fiberboard which is fitted beneath overlapping pieces of fiberboard at each corner (fig. 3). This container is not as widely used as several others, and is found principally in the Watsonville area.

This container holds 12 overwrapped heads of cauliflower and has an average gross weight of 22 pounds. The weight ranges from 20 to 25 pounds, depending on size and variety of cauliflower.

Full-Telescope Fiberboard Box for Single Layer

This is a die-cut corrugated box with a full-telescope top. It is single-walled and usually has inside dimensions of 20 by 18 by $5\frac{1}{2}$ inches. The dry mullen test is 250 pounds per square inch. Tare weight is 2.1 pounds. There are usually 26 ventilation holes approximately $1\text{-}3/8$ inches in diameter, 3 on each side, 4 on each end, 6 on top and 6 on the bottom. The number of ventilation holes or slots varies, however, depending on the type of container.

This container holds up to 12 overwrapped heads of cauliflower, and the gross weight averages 22 pounds, with a range from 20 to 25 pounds (fig. 4). The top and bottom halves are assembled by a semiautomatic stitching machine.

A corrugated fiberboard strip is placed on edge between heads of cauliflower to serve as a partition and to give additional support. Some plants fold this strip into a U-shaped support and some bend it in the form of a Z. Sometimes two strips are used to form an X.

One-Piece Fiberboard Box for Double Layer

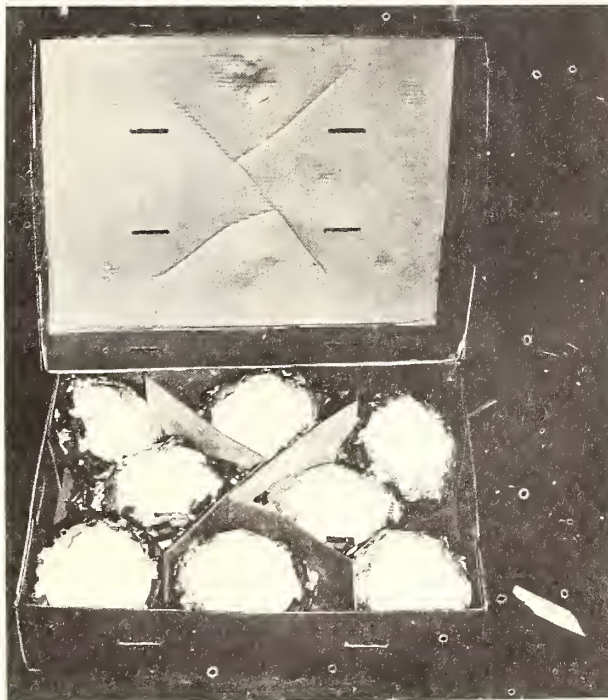
This box is single-walled with approximate inside dimensions of $18\text{-}3/8$ by $12\text{-}1/8$ by $11\frac{1}{2}$ inches. The board test is 200 pounds per square inch. Dividers in the bottom layer and extended folding end and side flaps in the top layer provide a full partition for each head of cauliflower. A double-faced corrugated pad, $15\text{-}3/4$ by $11\frac{1}{2}$ inches, separates the top and bottom layers. There are three ventilation holes on each side, $\frac{1}{4}$ by $3\frac{1}{2}$ inches, and two hand slots, one on each end, that are 1 by $3\frac{1}{2}$ inches. Tare weight is 2.5 pounds (fig. 5).

The usual pack per container is 12 heads; however, 14 heads are sometimes packed. When 12 heads are packed, each layer contains 6 heads. When 14 heads are packed, 6 are in the bottom layer, and 8 (slightly smaller) are in the top layer. The closure is formed by folding extended side flaps down through the center. The container weighs an average of 23 pounds gross, with a range of 20 to 26 pounds. It is manually assembled and closed.



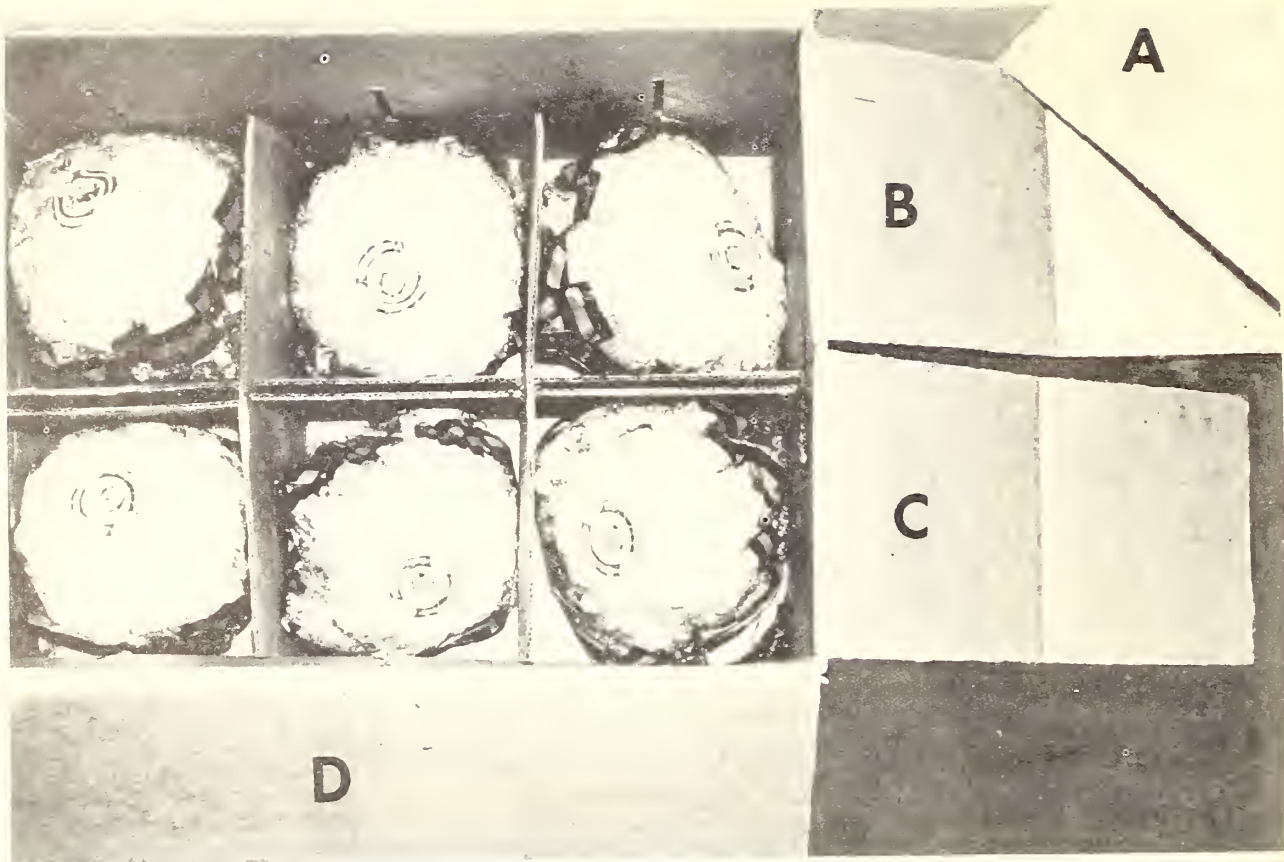
N-20430

Figure 3.--One-piece fiberboard box containing 12 heads of trimmed and wrapped cauliflower.



BN-9332-X

Figure 4.--Full-telescope fiberboard box for a single layer, containing 8 heads of wrapped cauliflower. It usually holds 12 heads.



BN 9273-X

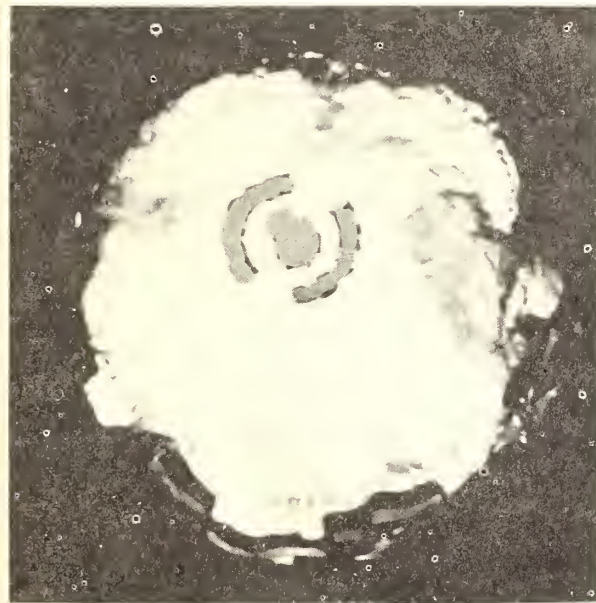
Figure 5.--Here the first layer of cauliflower is packed in a one-piece fiberboard box made for a double layer. Note fiberboard dividers. Next, pad A will be laid atop the dividers and six more heads of cauliflower will be packed. End flaps B and C will be folded over and pressed down behind the top two heads on right. Similar flaps on left end (not shown) will be folded over and down behind two top heads on left. Side flap D will be folded over and down behind three near heads. Side flap E on far side, not shown, will fold over and down behind three heads on far side.

Cellophane without Laminated Foil Strips

Semimoistureproof cellophane sheets, 300 gage, without the laminated foil were used in about half of the plants observed. This cellophane sheet is wrapped around the cauliflower with the ends folded over the stalk and heat-sealed by lightly pressing it down upon a hotplate.

The cellophane sheets were all printed with the brand of the packer. Since most such sheets are airtight, they are usually perforated, most commonly with 6 holes $\frac{1}{4}$ inch in diameter in a circle in the center of the sheet. The number of holes ranged from 4 to 8. Sizes of the cellophane sheets ranged from 16 by 16 $\frac{1}{2}$ to 18 by 18 inches. The sheet most commonly used was 16 $\frac{1}{2}$ by 17 inches.

One head of fully trimmed cauliflower is wrapped in each sheet. The trimmed head weighs an average of 2 pounds, with a range of 1 to 3 pounds (fig. 6).



BN 9272-X

Figure 6.--Head of fully trimmed cauliflower overwrapped with cellophane sheet.

Cellophane with Laminated Foil Strips

This is a 300-gage semimoisture-proof cellophane sheet. There are two strips of laminated foil .0007 inch thick, 1 inch wide, varying in length from 16 $\frac{1}{2}$ inches to 17 $\frac{1}{2}$ inches. One head of cauliflower is wrapped in each sheet of cellophane. The weight of a fully trimmed head of cauliflower averages 2 pounds, but may range from 1 to 3 pounds.

When cauliflower is wrapped with this type of cellophane, the edges of the sheet are wrapped or folded over the stalk end of the cauliflower and twisted. The laminated foil strips hold the twist in place and form the closure. This twist closure is not airtight; therefore, most cellophane with laminated foil does not have ventilation holes.

WEIGHT OF CAULIFLOWER, BY STAGE OF TRIMMING AND BY CONTAINER

To determine the amount of edible cauliflower shipped in the various containers evaluated, researchers weighed 803 heads in 5 plants, at various degrees of trimming. The smallest number of heads weighed in any plant was 62 and the largest was 204. Heads were weighed untrimmed as they came from the field, and again after trimming for the bulk pack in the WGA crate, the pony crate, and the wood flat, and for prepackaging. The degree of trimming varied from

slight in the bulk pack in the WGA crate to almost complete for the heads that were prepackaged. Prepackaged cauliflower was trimmed almost the same regardless of the master container in which it was to be shipped. Average weights recorded are listed in table 1.

Table 1.--Comparison of weights of cauliflower heads in various stages of trimming for different bulk packs and for prepackaging, California, 1958

Packing-house	Number of heads weighed	Average weight of untrimmed head	Weight after trimming for:			
			WGA crate 1/	Pony crate 1/	Wood flat 1/	Pre-packaging
Code identity	Number	Pounds	Pounds	Pounds	Pounds	Pounds
1 ...	62	5.60	3.14	3.02	2.28	1.69
2 ...	202	5.48	3.02	2.90	2.16	1.51
3 ...	148	5.50	3.04	2.92	2.18	1.59
4 ...	204	5.63	3.17	3.05	2.31	1.72
5 ...	187	5.51	3.05	2.93	2.19	1.60
Total and averages	803	5.54	3.08	2.96	2.22	1.62

1/ Bulk pack.

The average weight of an untrimmed head of cauliflower was 5.54 pounds. After it was fully trimmed for overwrapping and packing in the master shipping container, it weighed an average of 1.62 pounds. The reduction in weight after trimming the leaves and stalks for prepackaged cauliflower averaged 3.92 pounds or 70 percent.

The average reduction in weight by trimming leaves and stalk from a cauliflower head for packing in the WGA crate was 2.46 pounds; for the pony crate, 2.58 pounds; and for the wood flat, 3.32 pounds.

There was a slight variation among the packing houses in the amount of leaves and stalks trimmed in packing the different containers. There were also slight differences in sizes of cauliflower heads. However, researchers tried to select the same sizes of cauliflower for weight determination in the various stages of trimming.

All of the fully trimmed cauliflower was assumed to be edible. Since the average weight of a fully trimmed head was 1.62 pounds, 61.73 heads would be needed to provide 100 pounds of edible cauliflower. To ship 61.73 heads packed in bulk would require 3.43 WGA crates, which hold 18 heads each, or 5.14 crates of any other type, which normally hold 12 heads each.

Using these figures, the container tare weights already listed, and the average trim weights in table 1, the gross weight of containers, leaves and stalks, and 100 pounds of edible cauliflower, bulk and prepackaged, were computed by container (table 2).

Table 2.--Computed gross weight of container and pack per 100 pounds of edible cauliflower, bulk and prepackaged, by type of container

Pack and container	Tare weight	Leaves, stalks	Edible cauliflower	Gross weight
	Pounds	Pounds	Pounds	Pounds
Bulk:				
WGA crate	30.87	90.14	100	221.01
Pony crate	32.89	82.65	100	215.54
Wood flat	27.75	37.00	100	164.75
Prepackaged:				
Wood flat	27.75	0	100	127.75
1-piece f/b box for: single layer	12.85	0	100	112.85
Full-telescope f/b : box for single layer	10.79	0	100	110.79
1-piece f/b box for: double layer	12.85	0	100	112.85

These computations indicated that the bulk pack of cauliflower with the least trimming weighed 221.01 pounds per 100 pounds of edible cauliflower, compared to a gross weight of 110.79 pounds of fully trimmed cauliflower in the lightest fiberboard box. The wood flat, when used for a bulk pack, had a gross weight of 164.75 pounds per 100 pounds of edible cauliflower, compared to 127.75 pounds when used for fully trimmed prepackaged cauliflower.

MATERIALS COST OF CONTAINERS AND FILMS

Average container and materials costs are listed in table 3.

The wood flat for the bulk pack and the one-piece, two-layer fiberboard box for the prepackaged cauliflower were the least expensive containers. Per 100 pounds, the container and material costs amounted to \$2.67 and \$2.72, respectively.

COST AND AMOUNT OF DIRECT LABOR FOR PACKING AND LOADING

Only plant operations directly connected with prepackaging and packing were studied. Labor for bringing in cauliflower, dumping, grading, sorting, hydrocooling, and supervision was not included as it was the same for all containers packed in the same plant. Since there were variations in the weights and sizes of the pack in the different containers, the labor requirements and

Table 3.--Cost of containers and materials for bulk and prepackaged cauliflower, California, 1958-59 1/

Container	Per container		Per 100 pounds of edible cauliflower <u>2/</u>	
	1958	1959	1958	1959
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Bulk:				
WGA crate <u>3/</u>	0.74	0.81	2.54	2.78
Pony crate	0.58	---	2.98	---
Wood flat	0.48	<u>5/</u> 0.52	2.46	2.67
Prepackaged: <u>4/</u>				
One-piece f/b box for single layer	0.35	0.34	1.80	1.74
Two-piece full-telescope f/b box for single layer ..	0.34	0.33	1.74	1.69
One-piece f/b box for double layer	---	0.30	---	1.54
Wood flat	0.48	0.49	2.46	2.52
Film used for prepackaging:				
Laminated foil lock type cellophane (12 sheets per container)	0.28	0.27	1.44	1.38
Heat-seal type cellophane (12 sheets per container) ..	0.23	0.19	1.18	0.98

1/ Cost figures are based on quotations received from packers and manufacturers and include 10 percent allowance for waste. They also include costs of container covers, staples, pads, labels, glue, and nails.

2/ Equivalent of 3.43 WGA crates and 5.14 containers of all other types.

3/ This container held 18 heads; the others normally 12.

4/ Film cost must be added to container cost to determine total materials cost for prepackaged cauliflower.

5/ Includes pad.

costs are presented by container and by 100 pounds of edible cauliflower. The labor time in this report has been adjusted to cover personal time and fatigue.

Operations Performed

All of the bulk containers were of wood and had certain labor requirements in common, such as assembly (done before reaching the packing plant), packing, and closing. All of the containers for prepackaged cauliflower had certain features that were similar but that differed from those of the bulk containers.

Bulk

Operations performed in packing cauliflower in bulk containers were as follows:

Trimming.--Cauliflower heads arriving at the packing plant were dumped onto a conveyor or trimming table. Workers partially trimmed off top leaves and part of the stalk, and placed the heads on a conveyor to the hydrocooler (fig. 7). The trimmers usually inspected and sorted at the same time. The heads that did not meet specifications for packing were pushed into a chute to be carried out of the plant for disposal.



BN-6359-X

Figure 7.--Here the outer leaves and part of the stalk are trimmed and placed on a conveyor.

Packing.--Workers placed an average of 12 heads in the pony crate and the wood flat, and 18 heads in the WGA crate. A second slight trimming was usually performed on cauliflower being packed in the pony crate and a more severe trimming on heads for wood flats. After the workers had packed the heads in the pony crate or wood flat, they took a long knife and trimmed protruding leaves flush with the top of the crates.

Topping.--The WGA crate was closed with a semiautomatic hydraulic lidding press and nailed manually while the press held the lid in place, or was closed by a semiautomatic nailing machine.

The pony crate and wood flat were usually nailed manually. Workers placed a pad and then a lid on top of the cauliflower, and drove three to five nails in each end.

Stacking, labeling and stamping.--After the wood containers had been packed, they were either stacked for removal by a clamp truck or were placed on a conveyor to move to the loading dock. When containers were stacked, a worker glued a label and stamped the count of cauliflower heads on each container. In some plants, two or more workers were used for the labeling and stamping operations. When containers were placed on a conveyor, a worker placed a label on each container as it passed.

Loading and bracing.--The containers were counted and loaded into a car, or stacked to await loading. In the car, the pony crates were stacked 7 to 8 high, 5 wide, lengthwise on bottoms. The WGA crates were stacked 4 high, 5 wide, lengthwise on sides, and the wood flats were stacked 10 or 11 high, 4 wide, crosswise on bottoms. Space fillers or type B centergates were installed at the doorway of the cars to take up lengthwise slack. Car strips also were nailed on the sides of the wood flats at each layer.

Prepackaged

There were normally more operations performed in prepackaging than in bulk packing cauliflower, as follows:

Trimming.--In trimming cauliflower to be prepackaged, a much greater quantity of leaves and stalks was removed than in bulk packing. Sometimes when a plant was packing both bulk and prepackaged cauliflower, all heads were partially trimmed. After they had been inspected and sorted, the heads that were to be prepackaged underwent a second severe trimming to remove almost all the leaves and stalk. Under these conditions, the two trimming operations were totaled. Generally, the workers fully trimmed the heads to be overwrapped and placed them on a conveyor for hydrocooling.

Wrapping.--The cauliflower emerged from the hydrocooler on a conveyor belt. Workers flanking the belt removed one head at a time and placed it upside down on a sheet of cellophane. If the cellophane was of the laminated foil strip type, the four corners of the cellophane were pulled over the stalk area and twisted. The foil strips held the twist which formed the closure. If the cellophane sheets were of the heat-seal type, the ends were folded over each other on the stalk and were pressed against a hotplate for a heat-seal closure. About half of the plants used the foil-lock type of cellophane, and some plants used both types (fig. 8).

Packing.--In some plants, the workers who wrapped the cauliflower also packed it in fiberboard boxes or wood flats. In most plants, the packing operation was performed by other workers, who took the wrapped cauliflower from a bin, table, or conveyor, and packed it into shipping containers.



BN-6358-X

Figure 8.--The cauliflower heads are wrapped with the foil-lock type of cellophane.

Closing and labeling.--Most of the workers who packed cauliflower also closed the containers. All the containers were closed manually except the wood flat, which sometimes was closed by a semiautomatic nailing machine.

The master shipping containers usually were stacked for transfer to the loading ramp by a clamp truck. Several plants used conveyors.

None of the fiberboard containers were labeled, because firm names and brands were printed on the containers at the factory. The number of heads of cauliflower was stamped and a label was glued on each wood flat.

Loading and bracing.--The one-piece fiberboard boxes for a single layer of cauliflower were loaded 12 high, 4 wide, crosswise on bottoms, in a solid load; and the two-piece full-telescope boxes for a single layer of cauliflower were loaded 11 high, 4 wide, crosswise on bottoms, in a solid load. The one-piece fiberboard boxes for a double-layer pack were loaded six high, two chimney stacks across, crosswise and lengthwise on bottoms in a solid load. The wood flats for a single layer of prepackaged cauliflower were loaded the same as the wood flats for bulk cauliflower--10 or 11 high, 4 wide, crosswise on bottoms in a divided load. In the one-piece fiberboard box single-layer loads, corrugated fiberboard sidewall spacers were nailed to the side walls of the railroad car at the center of each stack to prevent crosswise shift. In the two-piece full-telescope fiberboard box loads, car stripping was placed between alternate layers. No bracing or stripping was required for the one-piece fiberboard box double-layer pack. In the wood flat loads, car strips were nailed on the sides of the containers at each layer, and a type B centergate was used to take up lengthwise slack.

Labor Requirements

The labor requirements for packing cauliflower in bulk and in prepackaged master shipping containers in California are listed in table 4. These time figures are in man-minutes, and represent time required to perform packing operations per container and per 100 pounds of edible cauliflower. They do not include breakdown of machinery and packing equipment, time lost by changing to lots of cauliflower of different varieties, or waiting time for cauliflower to be supplied to the packing shed.

Table 4 shows that more labor was required for the overwrap packs than the bulk packs. The most time-consuming operations in prepackaging cauliflower were trimming and wrapping. The bulk cauliflower required less trimming than the prepackaged cauliflower. Also, the bulk cauliflower heads were not overwrapped. The average amount of labor to pack and load 100 pounds of edible cauliflower in the bulk containers was 19.17 man-minutes, compared to 35.82 man-minutes for the prepackaged cauliflower in master containers.

Direct labor requirements to pack 12 heads of overwrapped cauliflower in a wood flat were greater than for packing in a fiberboard box. Most of this difference was attributable to the trimming operation.

Most plants that packed the wood flats used a circular packing line. The cauliflower was slightly trimmed, inspected, sorted for bulk or prepackaging, and trimmed again if it was to be prepackaged. Sometimes there were three trimmings before the head was actually overwrapped and packed. These trimmings were added and averaged among plants to obtain labor requirements for trimming. In plants using the fiberboard containers, a straight-line method was generally used. With this method, only one full trimming was given to the cauliflower.

The time required to pack the WGA crate was the lowest among the bulk packs. The cauliflower in this crate was trimmed the least and this crate also had the advantage inherent in a larger pack.

There were variations in the amount of labor used for carloading the bulk and prepackaged containers. The WGA crate required .48 man-minute per 100 pounds of edible cauliflower as compared to .82 man-minute for the pony crate and 1.23 man-minutes for the wood flat. ^{1/} In each of these loads, space fillers or centergates were placed at the doorway of the railway cars. In the wood flat load, car stripping was nailed on the sides of the containers at each layer. Because of the stripping of each layer, the wood flat bulk pack required the most labor for carloading. Since the WGA crate held one-third more cauliflower heads than the other bulk packs and no additional stripping was necessary, it was the most efficient bulk pack to carload.

^{1/} Equivalent times for carloading 100 pounds of edible cauliflower calculated on basis of 3.43 WGA crates and 5.14 for all other containers.

Table 4.--Direct labor requirements for packing and loading cauliflower, by type of container, California, March and April 1958-59 ^{1/}

	Bulk	Prepackaged
Operation		
Assembling	Man- minutes <u>2/</u>	Man- minutes <u>0.40</u>
Trimming	2.52 1.98 2/ 2.61	3.48 3.00 0.31 0.21
Wrapping	--- --- --- ---	1.68 2.04 3.00 3.16
Packing	1.33 1.10 1.02 1.02	3/0.49 0.55 2.04 1.92
Closing	0.23 0.44 0.40 0.40	--- 0.24 0.55 0.77
Stacking, labeling, and stamping container	0.16 0.14 0.18 0.17	4/0.18 4/ 0.24 0.23
Loading and bracing in car	0.14 0.16 0.24 0.24	0.15 0.14 4/ 4/0.08
Total time per container	4.38 3.82 4.45 8.72	6.38 6.28 0.14 0.09
Total time per 100 pounds of edible cauliflower	15.02 19.63 22.87 44.82	32.79 32.28 6.46 33.40

1/ These labor requirements are average times from time study observations made in seven cauliflower packing plants. Allowance made for 15 percent personal and fatigue time.

2/ All wood containers were assembled at factory or distributing warehouse; labor for assembling included in cost of containers (table 3).

3/ Placing cover pad on top container included.

4/ Fiberboard masters did not require labeling.

5/ Conveyor directly from closing station to car loader.

The one-piece double-layer fiberboard box for prepackaged cauliflower required less carloading time than any of the bulk or overwrap packs. It was loaded solid with no stripping or centergates. In the fiberboard box single-layer loads, car stripping was placed between alternate layers in the two-piece fiberboard box load, and corrugated fiberboard sidewall spacers were nailed to the sidewalls of the railway cars at the center of each stack in the one-piece fiberboard box load. The wood flats for prepackaged cauliflower were loaded the same as the wood flats for bulk cauliflower; car strips were nailed on the sides of the containers at each layer, and a centergate was installed at the doorway of the car. The labor required to carload 100 pounds of edible cauliflower in the one-piece double-layer fiberboard box amounted to .46 man-minute as compared to .72 and .77 man-minute, respectively, for the single-layer two-piece and one-piece fiberboard boxes. ^{2/} The wood flat for prepackaged cauliflower was the least efficient to carload, requiring 1.23 man-minutes. ^{2/}

Labor Cost

Labor cost to pack and load California cauliflower was based on a wage of \$1.50 per hour. Table 5 shows the labor cost, by container, on an equivalent basis of 100 pounds of edible cauliflower.

Table 5.--Direct labor cost of packing and loading cauliflower, by container, per 100 pounds of edible cauliflower, California, 1959

Type of container	Per container	Per 100 pounds
	at rate of \$1.50/hour	of edible cauliflower at rate of \$1.50/hour
	<u>Dollars</u>	<u>Dollars</u>
Bulk:		
WGA crate	0.110	0.377
Pony crate	0.096	0.493
Wood flat	0.111	0.570
Prepackaged:		
Wood flat	0.218	1.120
One-piece f/b box for single layer	0.160	0.822
Full-telescope f/b box for single: layer	0.157	0.807
One-piece f/b box for double layer	0.162	0.832

The direct labor cost of packing and loading bulk cauliflower in wood containers was less than for prepackaged cauliflower in either the fiberboard boxes or the wood flat.

^{2/} See footnote 1, page 22.

The labor cost to prepack cauliflower was higher because of closer trimming of leaves and stalk and overwrapping the cauliflower heads with film.

Of the bulk containers, the WGA crate costs less to pack and load--38 cents per 100 pounds of edible cauliflower, compared to 57 cents for the wood flat.

Among the master shipping containers for prepackaged cauliflower, the wood flat showed a direct labor cost about 30 cents higher than for the fiberboard master containers. The wood flat cost \$1.12 compared to an average of 82 cents for the three fiberboard boxes. However, it was observed in the two packing-houses that used the wood flats as master containers that the trimming operation was considerably slower than in packinghouses that used the fiberboard boxes.

COST OF TRANSPORTING CAULIFLOWER TO TERMINAL MARKET, BY TYPE OF CONTAINER

Most packing plants that shipped cauliflower to eastern markets from California shipped by rail. The majority of shipments were in carload lots. However, several packers shipped mixed carloads containing cauliflower, broccoli, escarole, endive, and cabbage. When cauliflower was shipped locally, it was usually by truck. Since all shipments inspected by AMS researchers at terminal markets were by rail, only rail transportation costs will be shown.

Freight Charges

On the basis of weights observed in this study, freight charges from California to New York City were computed by container and per 100 pounds of edible cauliflower (table 6). The number of containers usually loaded per car also was indicated.

Freight rates from the various cauliflower-producing areas of California to New York City are approximately the same. The rate of \$2.55 per 100 pounds gross from Guadalupe was chosen as typical to serve as a basis for these computations. 3/

Freight charges on bulk cauliflower with the least degree of trimming were computed to be twice as high per 100 pounds of edible cauliflower as fully trimmed prepackaged heads in the lightest container. The WGA crate had the highest computed freight charge per 100 pounds of edible cauliflower. It cost \$5.62, compared to a low of \$2.82 for cauliflower in the full-telescope fiberboard box for a single layer.

The number of containers loaded per car ranged from 340 WGA crates with an 18-head pack to 1,068 one-piece fiberboard boxes for a single-layer 12-head pack.

3/ From item 3180-F, Supplement 81 to 44-7, Continental Freight Bureau.

Table 6.--Estimated freight charges per container and per 100 pounds of cauliflower, and average number of containers usually loaded per car, Guadalupe, Calif., to New York City, April 1959 ^{1/}

Item	Estimated	Estimated	Estimated	Estimated	Average
	gross weight:	gross weight:	gross weight:	charge	number of
	per	per	per	per 100 lb.	containers
	container	charge per	edible	edible	usually loaded
		container	cauliflower	cauliflower	per car
	Pounds	Dollars	Pounds	Dollars	Number
Bulk:					
WGA crate	64.43	1.64	221.01	5.64	340
Pony crate	41.93	1.07	215.54	5.50	500
Wood flat	32.05	0.82	164.75	4.20	840
Prepackaged:					
One-piece f/b box for single					
layer	21.95	0.56	112.85	2.88	1,068
Full-telescope f/b box for single:					
layer	21.55	0.55	110.79	2.82	1,012
One-piece f/b box for double					
layer	21.95	0.56	112.85	2.88	936
Wood flat	24.85	0.63	127.75	3.26	840

^{1/} The only difference between the 1958 and 1959 freight charges was the elimination of a 3 percent Federal transportation tax in 1959.

Refrigeration Charges

Many variations of refrigeration are available to vegetable shippers. However, table 7 lists only the charges for those types most often observed during the late winter and early spring when these studies were made.

Bulk cauliflower in wood containers was top-iced after loading. Prepackaged cauliflower, both in fiberboard boxes and in wood flats, was shipped under either standard or mechanical refrigeration. All refrigeration charges were on a carload basis.

Table 7.--Refrigeration charges, by container and per 100 pounds of edible cauliflower, from Guadalupe, Calif., to New York City, April 1959 1/

Type of container	Charges per car <u>2/</u>	Number of containers per car	Charge per container	Charge per 100 lbs. of edible cauliflower
	<u>Dollars</u>	<u>Number</u>	<u>Dollars</u>	<u>Dollars</u>
Bulk: <u>3/</u>				
WCA crate	39.55	340	0.116	0.398
Pony crate	Do.	500	0.079	0.406
Wood flat	Do.	840	0.047	0.241
Prepackaged: <u>4/</u>				
One-piece f/b box for single layer	121.67	1,068	0.114	0.586
Full-telescope f/b box for single layer	Do.	1,012	0.120	0.617
One-piece f/b box for double layer	Do.	936	0.130	0.668
Wood flat	Do.	840	0.145	0.745

1/ The 1958 refrigeration charges are approximately the same as those shown for 1959.

2/ National Perishable Freight Committee, Perishable Protective Tariff No. 17.

3/ Charges shown are for top-of-body icing.

4/ Charges shown are for standard refrigeration with initial bunker icing of 10,000 pounds, or for mechanical refrigeration.

Bulk cauliflower refrigeration costs were less than those for prepackaged cauliflower. It cost an average of 6.8 cents for 12 heads in bulk containers, compared to 12.7 cents for 12 prepackaged heads in master containers. Bulk cauliflower is usually shipped in cars with top-of-body icing.

It cost an average of 34.8 cents for refrigeration to ship 100 pounds of edible cauliflower from California to New York in bulk containers with top-of-body icing, compared to an average of 65.4 cents for cauliflower in master shipping containers under mechanical refrigeration.

Loading Materials

The method of bracing the load in the car varied not only among containers but also from area to area and even among shippers in the same area. Comparative costs of materials for the methods of bracing most often observed are listed in table 8.

Table 8.--Comparative costs of bracing materials used in carloads of bulk and prepackaged cauliflower shipping containers, California, April 1959 1/

Loading materials	Type of container						
	Bulk			Prepackaged			
	WGA crate 2/	Pony crate 3/	Wood flat 4/	One-piece f/b box for single layer 5/	Full- telescope f/b box for single layer 6/	One-piece f/b box for double layer	Wood flat 4/
Number in car	340	500	840	1,068	1,012	936	840
	<u>Dol.</u>	<u>Dol.</u>	<u>Dol.</u>	<u>Dol.</u>	<u>Dol.</u>	<u>Dol.</u>	<u>Dol.</u>
Lumber	1.89	1.74	14.58	---	8.85	0	14.58
Nails	0.93	0.99	7.62	0.84	0.31	0	7.62
Corrugated wall braces	---	---	---	6.77	---	0	---
Total	2.82	2.73	22.20	7.61	9.16	0	22.20
Per container	0.0083	0.0055	0.0264	0.0071	0.0091	0	0.0264
Per 100 lbs. of: edible							
cauliflower ..	0.028	0.028	0.135	0.036	0.047	0	0.135

1/ The 1958 bracing materials were approximately the same as those of 1959.

2/ Cost of materials for space fillers used to take up lengthwise slack in the load.

3/ Cost of materials based on actual cost of 3 carloads in 1958; no data obtained in 1959.

4/ Cost of materials for horizontal and vertical stripping and for type B space frame.

5/ Cost of materials for corrugated fiberboard sidewall spacers.

6/ Cost of materials for car strips placed in alternate and top layers of each stack.

The wood flat was the most expensive to brace in both bulk and overwrapped cauliflower packs. Every layer of every stack was braced. The cost was 13.5 cents per 100 pounds of edible cauliflower.

The one-piece fiberboard box for a double-layer pack was not braced. It was stacked in a solid load, a tight chimney load, or a combination of both.

The variation of cost among other containers was slight.

COMPARATIVE TOTAL COST OF PACKING AND SHIPPING

Total costs of packing materials, labor, freight, refrigeration, and bracing materials were tabulated in order to permit an overall comparative evaluation by container and by 100 pounds of edible cauliflower packed and shipped (table 9).

Table 9.--Comparative cost of packing and shipping 100 pounds of edible cauliflower by type of container, California to New York, April 1959

Item	Type of container						
	Bulk			Prepackaged 2/			
	WGA crate	Pony crate 1/	Wood flat	One-piece:	Full-	One-piece:	Wood flat
				f/b box for single layer	telescope f/b box for single layer	f/b box for double layer	
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
Packing materials:	2.78	2.98	2.67	2.92	2.87	2.72	3.70
Packing and loading labor ...	0.38	0.49	0.57	0.82	0.81	0.83	1.12
Freight	5.64	5.50	4.20	2.88	2.82	2.88	3.26
Refrigeration ...	0.40	0.41	0.24	0.59	0.62	0.67	0.75
Bracing materials:	0.03	0.03	0.14	0.04	0.05	---	0.14
Total cost ..	9.23	9.41	7.82	7.25	7.17	7.10	8.97

1/ 1958 costs.

2/ Materials costs of container for prepackaged cauliflower include the average cost of 61 sheets of laminated foil and heat-seal types of cellophane.

The three fiberboard master shipping containers for fully trimmed prepackaged cauliflower and the wood flat for the trimmed bulk pack were the most economical to ship, on the basis of 100 pounds of edible cauliflower. Comparing the most efficient fiberboard container for prepackaged cauliflower with the most efficient bulk pack, the saving amounted to 72 cents per 100 pounds of edible cauliflower when prepackaged and shipped in a two-layer, one-piece fiberboard box. The average cost to ship prepackaged cauliflower in the three fiberboard master containers was \$7.17. The cost to ship bulk cauliflower in the wood flat was \$7.82.

The pony and WGA crates for bulk pack and the wood flat for prepackaged cauliflower were the most expensive containers to pack and ship. The average cost was \$9.20 per 100 pounds of edible cauliflower. The cost of the WGA crate bulk pack was 18 cents less than that of the bulk pony crate.

The wood flat when used for bulk cauliflower cost less than when used for prepackaged cauliflower despite its weight disadvantage, which pushed freight charges considerably higher. However, the higher freight charge was counter-balanced by lower packing materials and labor costs and lower refrigeration charges. The bulk pack required no cellophane sheets for the overwrap and very little labor for the partial trim. The refrigeration charge was lower because the bulk pack in the wood flat was top-iced and did not require standard or mechanical refrigeration in transit. The cost of the wood flat for the bulk pack was \$1.15 less than for the same wood flat for the overwrap pack.

ARRIVAL CONDITION OF CAULIFLOWER AND CONTAINERS

Test Shipments

Research workers made 18 rail test shipments of cauliflower during the spring of 1959. In each test shipment, comparisons were made between two types of containers or two types of packs. Two test shipments had three types of containers and packs, enabling the research workers to make a total of 21 comparisons. Six comparisons were made between the two-piece, full-telescope fiberboard box for a single layer and the one-piece, double-layer fiberboard box for prepackaged cauliflower; eight comparisons between the wood flat for a single layer of prepackaged cauliflower, and the wood flat for a single layer of bulk partial-trim cauliflower; five comparisons between the wood flat for a single layer of prepackaged cauliflower and the bulk WGA crate with two layers; and two preliminary comparisons were made between shipping prepackaged cauliflower in the wood flats with and without top pads. The bulk pony crate and the one-piece, single-layer fiberboard box for prepackaged cauliflower were not included in these tests, because they were not available.

Terminal and Retail Market Evaluations

The amount of product damage, condition of the container and packaging materials, and the trade reaction to bulk and prepackaged cauliflower for the paired tests were recorded by research workers in the terminal markets. Only trade reaction was recorded in the retail stores.

Product Damage

Two-piece telescope fiberboard box for single layer versus one-piece fiberboard box for double layer.--In six paired tests, the one-piece double-layer box showed less bruising and discoloration, in all degrees, than the two-piece telescope single-layer box (table 11). There was significantly more "slight" bruising in the single-layer pack. In the two-piece single-layer pack, 0.5 percent "serious" bruising damage was recorded. No "serious" bruising damage was found in the one-piece double-layer pack. Discoloration was not high for either the one- or two-piece fiberboard boxes.

Table 11.--Bruising and discoloration of cauliflower on arrival in terminal markets, 19 comparisons by types of container and pack, 18 test shipments, 1959

Type of pack and container	Type of damage							
	Bruising				Discoloration			
	Slight	Damage	Percent	Slight	Damage	Percent	Slight	Damage
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
<u>Six tests:</u>								
Two-piece fiberboard box, single layer, prepackaged	1/8.9	3.1	0.5	5.4	2.8	0		
One-piece fiberboard box, double layer, prepackaged	1/5.2	1.4	0	4.1	1.2	0		
<u>Eight tests:</u>								
Wood flat, single layer, prepackaged	2/16.7	6.9	0.9	12.4	3.6	0.5		
Wood flat, single layer, bulk ..	2/11.6	5.0	1.6	11.0	3.7	0.4		
<u>Five tests:</u>								
Wood flat, single layer, prepackaged	3/11.5	4.6	3/0.8	9.5	2.8	4/0		
WGA crate, two layers, bulk ...	3/10.6	6.6	3/8.2	8.6	2.4	4/0.9		

Note: The degree of bruising and discoloration was determined by the size of the area affected: Slight - less than $\frac{1}{2}$ inch in diameter; damage - $\frac{1}{2}$ to 1 inch; and serious - more than 1 inch.

1/ Difference in slight bruising was significant at the 5 percent level.

2/ Difference in slight bruising was significant at the 1 percent level.

3/ Differences in slight and serious bruising were significant at the 1 percent and 5 percent levels, respectively.

4/ Difference in serious discoloration was significant at the 1 percent level.

Wood flat, single layer, for prepackaged cauliflower versus wood flat, single layer, for bulk cauliflower.--There was significantly more "slight" bruising of the prepackaged cauliflower than the bulk cauliflower (table 11). There was also 2 percent more "damage" bruising in the prepackaged packs. The prepackaged cauliflower showed slightly less "serious" bruising damage. Differences in total discoloration between the packs were less than 1½ percent. Most of the discoloration recorded was of the "slight" degree.

Wood flat, single layer, for prepackaged cauliflower versus the WGA crate, 2 layers, for bulk cauliflower.--Compared to the bulk WGA crate, there was significantly less bruising in the prepackaged wood flat packs (table 11). The amount of "serious" bruising found in the WGA bulk pack was high--averaging 8.2 percent--compared to that in the prepackaged cauliflower in the wood flats, averaging less than 1 percent. The difference in discoloration found in both packs was small; however, no "serious" discoloration was found in the prepackaged pack, whereas 0.9 percent "serious" discoloration was recorded for the bulk pack.

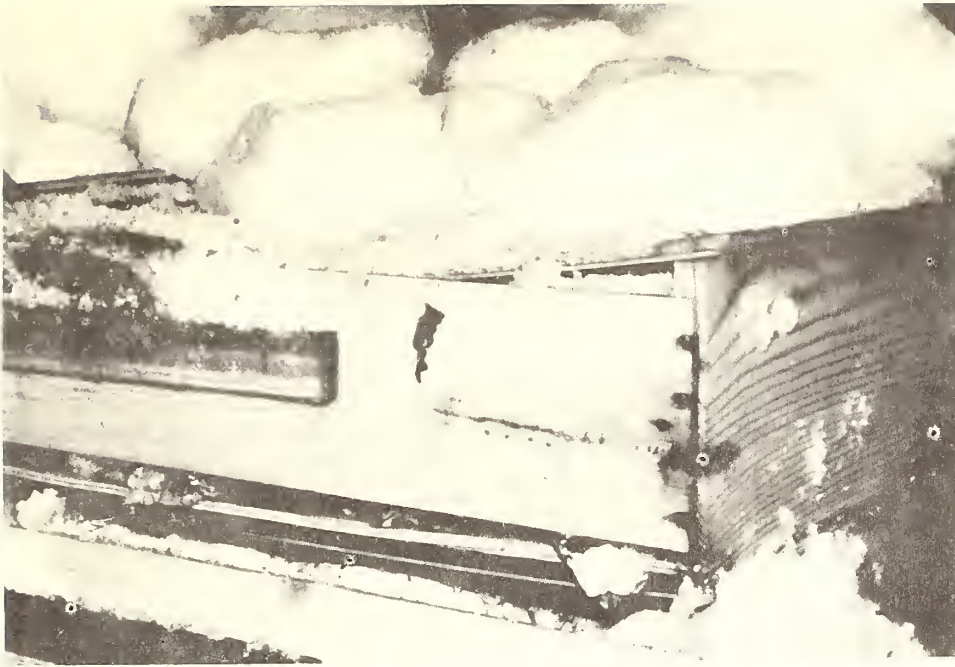
Wood flat, single layer, for prepackaged cauliflower with and without pads.--In addition to the container comparison tests, two preliminary tests were made in an effort to reduce the amount of bruising and discoloration damage in the Prepackaged wood flat packs. A blotter-type pad was placed on top of the prepackaged heads before closing, and these packs were compared with the same packs without blotter pads. On arrival, the total amount of bruising was approximately 50 percent less when top pads were used, and discoloration damage about 35 percent less. These two shipments indicated that a top pad would probably be effective in reducing bruising and discoloration injury.

Condition of Containers and Packaging Materials

Damage to containers differed by type of container shipped, method of stacking, type of refrigeration, and distance hauled. Damage occurring during transit of cauliflower, by type of container, was as follows:

Two-piece full-telescope fiberboard box for a single layer and one-piece fiberboard box for double layer.--In two of six shipments, the sides and ends of the one-piece box for double layers were scuffed or skinned, and about 5 percent of the tops, sides, and ends were slightly crushed and dented. The two-piece box was slightly skinned on sides and ends.

Wood flat with prepackaged cauliflower and wood flat with bulk pack.--Of eight test shipments inspected at terminal markets, seven had no evident damage. In one shipment, both packs showed damage. The wood flat with overwrapped cauliflower had about 10 percent of the top and side strips broken and splintered. Rough handling and transit shocks were probable causes. The wood flats with bulk pack also had about 10 percent of the tops and about 5 percent of the side strips broken. Overhead weight of top ice or transit shocks, or both, were probable causes (fig. 9).



BN-9334-X

Figure 9.--Damage to wood flat bulk pack caused by overhead weight of top ice.

Wood flat with prepackaged cauliflower and the bulk WGA crate.--The wood flat with overwrapped cauliflower showed damage in only one of the five shipments inspected. About 10 percent of the containers had broken, crushed, and splintered tops and sides. The damage to some containers caused injury to the cauliflower. Rough handling and transit shocks probably were causes of the damage.

In two out of five shipments, the WGA bulk packs were damaged, about 10 percent of the top strips were broken or splintered, and the top bulge common to the WGA crate was crushed. The most probable causes were rough handling, transit shocks, and weight of top ice, or a combination of the three.

The WGA bulk packs in these two shipments were damaged enough to injure the cauliflower. In these shipments, serious damage (12.2 and 14.4 percent) was higher than slight damage or damage by bruising.

Cellophane overwraps.--Both the heat-seal and foil-lock types of cellophane held their closures satisfactorily in all shipments inspected. No damage was observed.

TRADE REACTION TO BULK AND PREPACKAGED CAULIFLOWER

Researchers obtained trade reaction at both terminal and retail levels. As noted earlier, there were always two types of cauliflower containers or two packs in the same type of container in each shipment inspected at terminal

markets; and usually both bulk and prepackaged cauliflower were on display in the retail stores at the same time. Thus, wholesale receivers and handlers and retail produce managers all were able to make direct comparisons.

At Terminal Level

Trade reactions to containers and packs at the terminal level are summarized as follows.

Full-telescope fiberboard box for single layer versus one-piece fiberboard box for double layer.--The one-piece box for a double layer of cauliflower was favored about 3 to 1. "It provides excellent protection for the cauliflower," was the usual comment. However, it was noted that, once opened, this one-piece box was quite difficult to close again. Comments favorable to the telescope box stressed its ease of opening and closing, strength, and suitability for stacking.

Wood flat with bulk pack versus wood flat with overwrap pack.--Opinion was split four ways. One group (a) liked both packs in the wood flat, (b) preferred the overwrap pack, (c) favored the bulk pack, and (d) did not like either pack in this container. Typical comments: (a) "The wood flats are O.K. they offer good protection to the cauliflower, wrapped or unwrapped...we can stack them as high as we want." (b) "The wrapped cauliflower is usually of better quality...bulk cauliflower moves too slowly." (c) "I prefer the unwrapped flower in the wood flat...if a head has browning or yellowing, you can shape it or trim it without removing any film." (d) "I don't care for these wood flats, wrapped or unwrapped...they are too much trouble to get into and there is always the wood to dispose of...a person needs gloves to avoid splinters...they don't do a good job of protecting overwrapped cauliflower."

Wood flats with overwrap pack versus WGA crates with bulk pack.--All favored the wood flats with overwrap pack. All judgments but one were based on preference for prepackaged cauliflower rather than on like or dislike of either container. The exception preferred the wood flat because "it offers good protection to the cauliflower and is easy to stack and handle."

At Retail Level

Reactions of retail store officials and produce managers are summarized as follows.

Full-telescope fiberboard box for single layer versus one-piece fiberboard box for double layer.--Six comments favored the double-layer box because of the belief it gave greater protection to the cauliflower, was easier to handle, and saved space. One produce manager considered the double-layer box too difficult to reclose and another liked both boxes equally well.

Wood flat with overwrap pack versus wood flat with bulk pack.--Three comments were critical of the flat, regardless of pack, because of the "difficulty" of opening and disposal. Two comments favored the overwrap pack because it sold better. One produce manager preferred the bulk pack because he felt that

the overwrap pack was too loose and the heads were subject to bruising. Another liked both packs equally well: "Both these wood flats are O.K.; they offer pretty fair protection to the cauliflower and you can stack them as high as you like."

Wood flat with overwrap pack versus WGA crate with bulk pack.--The comments indicated dislike of the WGA crate: "They are too heavy...hard to handle...the bruising in them seems greater."

Foil-edge wrap versus heat-seal wrap.--Comments in general indicated a preference for some form of overwrap because it "reduced handling" and "sold better." A few favored bulk heads "because people still like to take them in their hands and feel what they are getting." The foil-edge wrap was usually preferred because it could be reclosed easily if opened to trim off damaged or browned sections of the cauliflower. One produce manager maintained that the heat-seal wrap held its closure better.

F.O.B PRICES PAID FOR CAULIFLOWER, BY TYPE OF CONTAINER

Table 12 gives a range of f.o.b. prices received for cauliflower shipped in February, March, and April 1958 and 1959.

The pony crate and the wood flat with bulk packs of 12 heads brought the same f.o.b. prices. The WGA crate with a normal pack of 18 heads sold consistently higher but on an equivalent 12-head basis sold at slightly lower prices (about 17 cents).

The overwrapped packs of fully trimmed cauliflower in the two single-layer fiberboard boxes and in wood flats all brought the same f.o.b. prices, which were from 40 to 75 cents higher than the bulk packs in pony crates and wood flats. The average price advantage was about 60 cents. Prices received for the overwrapped pack in the one-piece fiberboard box for a double layer were the same during one month in 1959 as those received for the overwrap pack in the other containers. They were higher in one month, and were slightly lower, on the average, in one month.

When smaller heads were packed in the WGA crate, 20 to 22 heads instead of the usual 18, and 14 to 16 heads in the fiberboard box or wood flat instead of the usual 12 heads, the f.o.b. price was usually discounted 10 to 25 cents, depending on market demands.

CONCLUSIONS

Annual production of cauliflower in California for fresh market and processing is about 200 million pounds. ^{4/} Approximately 50 percent or about 100 million pounds of cauliflower for the fresh market is shipped out of the State.

^{4/} Vegetable Fresh Market - 1958 Annual Summary, AMS Crop Reporting Board, USDA.

Table 12.--Range of f.o.b. prices received for cauliflower, by type of container and method of packing, California, 1958-59 ^{1/}

Type of container and method of packing	1958			1959		
	February	March	April	February	March	April
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Bulk:						
WGA (18 heads)	2.00-2.75	2.50-2.75	2.25-2.75	2.25-2.75	1.75-2.25	1.75-2.75
WGA (per equivalent 12 heads)	1.33-1.83	1.67-1.83	1.50-1.83	1.50-1.83	1.17-1.50	1.17-1.83
Pony	1.50-2.00	1.75-2.00	1.50-2.00	1.75-2.00	1.25-1.75	1.25-2.25
Wood flat	1.50-2.00	1.75-2.00	1.50-2.00	1.75-2.00	1.25-1.75	1.25-2.25
Prepackaged:						
One-piece f/b box for: single layer	2.25-2.50	2.50-2.75	2.25-2.75	2.25-2.75	1.75-2.15	1.90-2.75
Telescope f/b box for: single layer	2.25-2.50	2.50-2.75	2.25-2.75	2.25-2.75	1.75-2.15	1.90-2.75
One-piece f/b box for: double layer	---	---	---	2.25-2.75	2.10-2.50	2.15-2.25
Wood flat	2.25-2.50	2.50-2.75	2.25-2.75	2.25-2.75	1.75-2.15	1.90-2.75

^{1/} Data obtained from Thomas C. Sublett, Jr., Federal-State Market News Service, Santa Maria, Calif., for all containers except the one-piece fiberboard box for a double layer. Prices listed for this container are based on sales of 12,000 double-layer fiberboard boxes.

Of the estimated 100 million pounds shipped out annually, about 60 million pounds are fully trimmed, overwrapped, packed, and shipped as fully edible cauliflower. The remaining 40 million pounds are only partially trimmed, and packed and shipped in bulk containers. The amount of edible cauliflower in bulk containers depends on the amount of untrimmed leaves left on the cauliflower.

Researchers estimated that if the 40 million pounds of cauliflower now being shipped out in bulk containers were to be fully trimmed, overwrapped, packed and shipped in master containers, shippers would save \$475,000 annually.

This saving was computed by averaging the direct cost to ship 100 pounds of edible cauliflower in all three bulk containers evaluated, compared to the cost to ship 100 pounds of edible cauliflower in all four master shipping containers evaluated.

When a comparison is made with only the wood flat bulk pack, the most economical of bulk containers, and the three fiberboard master containers for overwrapped cauliflower, a saving of \$125,000 is estimated. In this comparison, only containers that were principally used were compared.

It is unknown, of course, what the future relationship will be between prices of bulk and overwrapped cauliflower. During this study, prices of pre-packaged cauliflower exceeded comparable prices for bulk cauliflower. However, since future prices will be determined by supply and demand, the percent of cauliflower shipped bulk or prepackaged cannot be assumed or predicted.

